

# ASTM B462 / ASME SB462

## Standard Specification for Forged or Rolled UNS N06030, UNS N06022, UNS N06035, UNS N06200, UNS N06059, UNS N1 0362, UNS N06686, UNS N08020, UNS N08024, UNS N08026, UNS N08367, UNS N1 0276, UNS N1 0665, UNS N1 0675, UNS N1 0629, UNS N08031, UNS N06045, UNS N06025, UNS R20033 Alloy Pipe Flanges, Forged Fittings, and Valves and Parts for Corrosive High-Temperature Service

This specification covers forged or rolled UNS N06030, UNS N06035, UNS N06022, UNS N06200, UNS N06059, UNS N10362, UNS N06686, UNS N08020, UNS N08024, UNS N08026, UNS N08367, UNS N10276, UNS N10665, UNS N10675, UNS N10629, UNS N08031, UNS N06045, UNS N06025, and UNS R20033 pipe flanges, forged fittings, and valves and parts intended for corrosive high-temperature service.

### A. Heat Treatment :-

1. The product of UNS N08020 alloy shall be furnished in the stabilized-annealed condition. The product of UNS N08024 shall be furnished in the annealed condition. The product of UNS N06022, UNS N06035, UNS N08026, UNS N06030, UNS N06200, UNS N10362, UNS N10276, UNS N10665, UNS N10675, and UNS R20033 alloys shall be furnished in the solution annealed condition.

*NOTE 2—The recommended annealing temperatures all followed by water quenching or rapidly cooling by other means are:*

UNS N06030	2125 to 2175°F (1163 to 1191 °C)
UNS N06022	2025 to 2075°F (1107 to 1135°C)
UNS N06035	2025 to 2075°F (1107 to 1135°C)
UNS N06200	2075 to 2125°F (1135 to 1163°C)
UNS N06059	2025 to 2125°F (1107 to 1163°C)
UNS N10362	2075 to 2125°F (1135 to 1163°C)
UNS N06686	2125 to 2225°F (1163 to 1218°C)
UNS N08020	1700 to 1850°F (927 to 1010°C)
UNS N08024	1925 to 1975°F (1052 to 1079°C)
UNS N08026	2050 to 2200°F (1121 to 1204°C)
UNS N10276	2025 to 2075°F (1107 to 1135°C)
UNS N10665	1925 to 2000°F (1052 to 1093°C)
UNS N10675	1925 to 2000°F (1052 to 1093°C)
UNS N10629	1925 to 2000°F (1052 to 1093°C)
UNS N08031	2050 to 2160°F (1121 to 1182°C)
UNS N06045	2125 to 2190°F (1163 to 1199°C)
UNS N06025	2175 to 2240°F (1191 to 1227°C)
UNS R20033	2010 to 2150°F (1100 to 1180°C).

2. Alloy N08367 shall be furnished in the solution annealed condition.

3. The recommended heat treatment shall consist of heating to a minimum temperature of 2025°F (1105°C) and quenching in water, or rapidly cooling, by other means.
4. Heat treatment may be performed before machining.

**B. Chemical Composition :-**

The material shall conform to the requirements as to chemical composition prescribed in Table 1.

**Table 1**

	<b>UNS N08026</b>	<b>UNS N08020</b>	<b>UNS N08024</b>	<b>UNS N08367</b>	<b>UNS R20033</b>
Carbon, max	0.03	0.07	0.03	0.03	0.015
Manganese, max	1.0	2.0	1.0	2.0	2.0
Phosphorus, max	0.03	0.045	0.035	0.04	0.02
Sulfur, max	0.03	0.035	0.035	0.03	0.01
Silicon, max	0.5	1.0	0.5	1.0	0.5
Nickel	33.00–37.20	32.00–38.00	35.00–40.00	23.50-25.50	30.0–33.0
Chromium	22.00–26.00	19.00–21.00	22.50–25.00	20.00-22.00	31.0–35.0
Molybdenum	5.00–6.70	2.00–3.00	3.50–5.00	6.00-7.00	0.50–2.0
Copper	2.00–4.00	3.00–4.00	0.50–1.50	0.75 max	0.30–1.20
Columbium (Nb) + tantalum	...	8×carbon–1.00	0.15–0.35	...	...
Nitrogen	0.10–0.16	...	...	0.18-0.25	0.35–0.60
Iron	Remainder <sup>A</sup>	Remainder <sup>A</sup>	Remainder <sup>A</sup>	Remainder <sup>A</sup>	Remainder <sup>A</sup>

	<b>UNS N06030</b>	<b>UNS N06022</b>	<b>UNS N06200</b>	<b>UNS N10276</b>	<b>UNS 10665</b>	<b>UNS N10675</b>
Carbon, max	0.03	0.015	0.01	0.01	0.02	0.01
Manganese, max	1.5	0.5	0.5	1.0	1.0	3.0
Phosphorous, max	0.04	0.02	0.025	0.04	0.04	0.03
Sulphur, max	0.02	0.02	0.01	0.03	0.03	0.01
Silicon, max	0.8	0.08	0.08	0.08	0.1	0.1
Nickel	Remainder <sup>A</sup>	Remainder <sup>A</sup>	Remainder <sup>A</sup>	Remainder <sup>A</sup>	Remainder <sup>A</sup>	Remainder <sup>A</sup>
Chromium	28.0-31.5	20.0-22.5	22.0–24.0	14.5-16.5	1.0 max	1.0-3.0
Molybdenum	4.0-6.0	12.5-14.5	15.0-17.0	15.0-17.0	26.0-30.0	27.0-32.0
Copper	1.0-2.4	...	0.3-1.9	...	...	0.2
Columbium (Nb) + tantalum	0.30-1.50	...	...	...	...	...

Nitrogen	...	...	...	...	...	...
Iron	13.0-17.0	2.0-6.0	3.0 max	4.0-7.0	2.0 max	1.0-3.0
Cobalt, max	5.0	2.5	2.0	2.5	1.0	3.0
Tungsten	1.5-4.0	2.5-3.5	...	3.0-4.5	...	3.0 max
Vanadium, max	...	0.35	...	0.35	...	0.2
Titanium, max	...	...	...	...	...	0.2
Zirconium, max	...	...	...	...	...	0.10
Columbium (Nb)	...	...	...	...	...	0.20 max
Tantalum	...	...	...	...	...	0.20 max
Nickel+Molybdenum	...	...	...	...	...	94.0-98.0
Alu minum, max	...	...	0.5	...	...	0.5

	UNS N06059	UNS N10362	UNS N06686	UNS N08031	UNS N06045	UNS N06025	UNS N10629	UNS N06035
Manganese, max	0.5	0.6	0.75	2.0	1.0	0.15	1.5	0.5
Carbon, max	0.01	0.01	0.01	0.015	0.05-0.12	0.15-0.25	0.01	0.050
Phosphorous, max	0.015	0.025	0.04	0.02	0.02	0.02	0.04	0.03
Sulphur, max	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.015
Silicon, max	0.10	0.08	0.08	0.3	2.5-3.0	0.5	0.05	0.6
Nickel,	Remainder <sup>A</sup>	Remainder <sup>A</sup>	Remainder <sup>A</sup>	30.0-32.0	45 min	Remainder <sup>A</sup>	Remainder <sup>A</sup>	Remainder <sup>A</sup>
Chromium	22.0-24.0	13.8-15.6	19.0-23.0	26.0-28.0	26.0-29.0	24.0-26.0	0.5-1.5	32.25-34.25
Molybdenum	15.0-16.5	21.5-23.0	15.0-17.0	6.0-7.0	...	...	26.0-30.0	7.60-9.00
Copper	0.50 max	...	...	1.0-1.4	0.3 max	0.1 max	0.5	0.30 max
Yttrium	...	...	...	...	...	0.05-0.12	...	...
Nitrogen	...	...	...	0.15-0.25	...	...	...	...
Iron	1.5 max	1.25 max	5.0 max	Remainder <sup>A</sup>	21.0-25.0	8.0-11.0	1.0-6.0	2.00 max
Cobalt, max	0.3	...	...	...	...	...	2.5	1.0
Tungsten	...	...	3.0-4.4	...	...	...	...	0.60 max
Vanadium, max	...	...	0.02-0.25	...	...	...	...	0.2
Titanium, max	...	...	...	...	...	0.1-0.2	...	...
Zirconium, max	...	...	...	...	...	0.01-0.10	...	...
Columbium (Nb)	...	...	...	...	...	...	...	...
Tantalum	...	...	...	...	...	...	...	...
Cerium	...	...	...	...	0.03-0.09	...	...	...
Aluminum, max	0.1-0.4	0.5	...	...	...	1.8-2.4	0.1-1.5	0.4

<sup>A</sup> Shall be determined arithmetically by difference.

**C. Mechanical Properties and Other Requirements :-**

1. Mechanical Properties—The material shall conform to the requirements as to mechanical properties prescribed in Table 2 at room temperature.
2. Hydrostatic Tests—After machining, valve bodies, fittings, and other pressure-containing parts shall be tested to the hydrostatic shell-test pressures prescribed in ANSI B16.5 for the applicable alloy steel rating for which the forging is designed and shall show no leaks.
3. Macroetch Tests—Etching of tests shall show sound and reasonably uniform material, free of injurious laminations, cracks, segregations, and similar objectionable defects.

**Table 2**

Alloy	Tensile Strength, min		Yield Strength, min		Elongation 2 in. or 50 mm, min, %	Reduction of Area, min, %
	ksi	MPa	ksi	MPa		
UNS N08020, UNS N08024, and UNS N08026	80	551	35	241	30	50
UNS N08367	95	655	45	310	30	50
UNS R20033	109	750	55	380	40	...
UNS N06030	85	586	35	241	30	...
UNS N06022	100	690	45	310	45	...
UNS N06035	85	586	35	241	30	...
UNS N06200	100	690	45	310	45	...
UNS N10276	100	690	41	283	40	...
UNS N10665	110	760	51	350	40	...
UNS N10675	110	760	51	350	40	...
UNS N06059	100	690	45	310	45	...
UNS N10362	105	725	45	310	40	...
UNS N06686	100	690	45	310	45	...
UNS N08031	94	650	40	276	40	...
UNS N06045	90	620	35	241	35	...
UNS N06025	98	680	39	270	30	...
UNS N10629	110	760	51	350	40	...

**D. Tests Methods :-**

The chemical composition and mechanical properties of the material as enumerated in this specification shall, in case of disagreement, be determined in accordance with the following methods:

<u>Test</u>	<u>ASTM Designations</u>
Chemical analysis	E1473 <sup>A</sup>
Tension	E8

<sup>A</sup> Iron shall be determined arithmetically by difference.

#### **E. Supplementary Tests :-**

1. Corrosion Tests for UNS N08020:  
One intergranular corrosion test per heat shall be performed by the manufacturer on a sensitized specimen and tested in accordance with Practices A262.
2. Positive Material Identification Examination:  
Product shall receive a Positive Material Identification examination by Guide E1916.

#### **Related Keywords**

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